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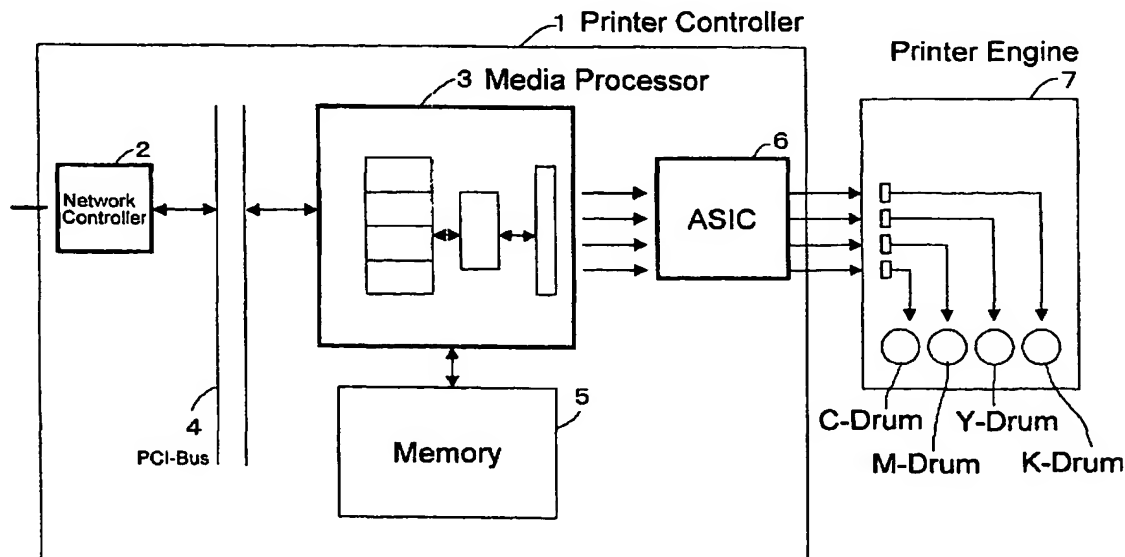
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GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: PRINTER CONTROLLER



(57) Abstract: The objective of the present invention is to provide a printer controller capable of processing image information such as four primary colors in parallel and transmitting processed data to a printer in a high-speed network environment. The printer controller arranged as follows attains the above-mentioned objective: a network controller for receiving data from an outside device; a digital signal processor having a VLIW structure capable of parallel processing; and a fixed logic LSI for receiving/transmitting data from/to a printer engine, where: respective cyan, magenta, yellow and black as four primary colors are allocated to respective clusters, and processed in parallel, and processed results are transmitted to the printer engine via the fixed logic LSI.

PATENT SPECIFICATION

PRINTER CONTROLLER

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BACKGROUND OF THE INVENTION

[0001] [Field of the Invention]

[0002] The present invention relates to a printer controller, which receives data for printing from a computer or the like, interprets received data, unfolds interpreted data into printing data and outputs printing data to a printer engine.

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[0003] [Brief Description of the Related Art]

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[0004] Usually a printer controller comprises a RISC processor or a CISC processor and a special purpose LSI so called "ASIC" having functions such as a direct access memory control, special image processing or the like, controlled by the RISC processor or the CISC processor.

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[0005] The above-mentioned printer controller sequentially processes color data, for example, in order of C>M>Y>K. Here reference characters C, M, Y and K represent four primary colors i.e. cyan, magenta, yellow and black. After the processed data is stored in a memory, the processed data is transmitted to the printer engine by the direct memory access controller consisted of the special purpose LSI such as the ASIC or the like, when the data is required to output via a printer.

25

[0006] A color table for the printer usually is determined uniformly, but the color table is not adjusted in accordance with changes in printing conditions.

30

[0007] The amount of printing data transmitted via networks is increasing recently, as the Internet is widely prevailing. In addition formats for printing data are diversifying into a PostScript, a PCL, a PDF and the like and the data volume is also increasing.

[0008] Further the following various improvements have been attained in printing apparatuses. (1) Printing rates are being increased to a larger extent by printer engines. (2) Higher resolutions, for example, from

600DPI to 1200DPI are being realized. (3) Higher resolutions in color display, for example, from 1 bit to 4 bit or further 16 bit for respective four primary colors, C, M, Y, K are also being realized. A fast network printer cannot be realized by utilizing a conventional printer controller, since a
5 processing rate of the image data by the printer controller is too low to keep up with the above-described improvements.

[0009] It is difficult to obtain stable and natural flavors in color expression, if the image data is processed in a uniform way, and if the color table for printing is not adjusted in accordance with diversified
10 printing formats and conditions. Also, it is difficult to express a texture peculiar to an object to be printed, unless an image processing on the object is performed properly.

[00010] SUMMARY OF THE INVENTION

15 **[00011]** In order to solve the above-mentioned problems, a printer controller capable of processing four primary colors C, M, Y, K in parallel in place of conventional sequential processing in order of C>M>Y>K, thus a much faster printing is realized.

[00012] In order to realize a fast printing, processed data unfolded as
20 bit map data is directly transmitted from a digital signal processor to a printer engine under a direct instruction from the digital signal processor.

[00013] Stable printing quality can be obtained, when a color matching table is properly optimized by utilizing a software in the digital signal processor but not by a uniform processing by the ASIC or the like.

25 **[00014]** Suitable printing color and expression can be also obtained, after identifying the object to be printed in an image area by utilizing the software.

[00015] BRIEF DESCRIPTION OF DRAWINGS

30 **[00016]** FIG.1 is a block diagram illustrating a basic arrangement of an embodiment according to the present invention.

[00017] FIG.2 is a block diagram illustrating an internal arrangement of a media processor.

[00018] FIG.3 shows a structure of a VLIW (Very Long Instruction Word).

5 [00019] FIG.4 shows information provided from the printer engine to the printer controller.

[00020] FIG.5 is a flow chart illustrating an adjusting procedure of the color table.

[00021] FIG.6 shows an example of printed data.

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[00022] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00023] Hereinafter embodiments according to the present invention are explained by referring to drawings.

15 [00024] FIG.1 is the block diagram illustrating the basic arrangement of the present invention. A reference numeral "1" is a printer controller comprising a network controller 2, a media processor 3, a PCI bus 4, a memory 5 and an ASIC 6. The printer controller 1 has functions for controlling a network, controlling a connecting interface to a personal
20 computer or a computer, interpreting a language, unfolding interpreted data and transmitting unfolded bit map data to the printer engine. Usually a RISC processor or a CISC processor is used as the network controller 2, which controls the network and the connecting interface to the personal computer or the computer. Sometimes, the language
25 interpretation may be executed by the network controller 2. The media processor 3 is a kind of digital signal processor, but usually means the digital signal processor with high performance. A micro architecture of the media processor is called the VLIW (Very long Instruction Word). The network controller 2 and the media processor 3 are connected via the
30 PCI bus 4. The memory 5 usually comprising an SDRAM, stores system software for the media processor 3 and application programs of a PDL (Page Description Language). The ASIC 6 is a fixed logic LSI, receives

independent signals on primary colors, C, M, Y, K from a data transfer controller (which will be explained below) in the media processor 3, converts received signals into video signals and transmits video signals to a printer engine 7. The printer engine 7 is arranged in, for example, a color laser beam printer having drums for four primary colors, C, M, Y, K and controls C, M, Y, K drums independently.

[00025] FIG.2 is the block diagram illustrating the internal arrangement of the media processor 3. A reference numeral "8" is a VLIW core for executing parallel instructions. A reference numeral "9" is called a data cache having a function of storing data to be processed. A reference numeral "10" is called an instruction cache having a function of storing instructions. A reference numeral "11" is an internal bus connected to respective units. A reference numeral "12" is a PCI unit for converting signals so as to connect the internal bus 11 to the PCI bus 4 (see FIG.1). A reference numeral "13" is the data transfer controller having a function of transferring data among respective units under ordinary instructions. A reference numeral "14" is a data port for receiving independent bit map data of respective colors, C, M, Y, K from the data cache 9 under instructions from data transfer controller 13. A reference numeral "15" is a memory controller for controlling the external memory 5.

[00026] FIG.3 shows the structure of the VLIW, the most important portion of the present invention. As one of the examples, four processing flows executed by four parallel instructions for four primary colors are illustrated in FIG.3. As a first step, a printer data file is received and interpreted into display lists. Independent instructions for respective four primary colors C, M, Y, K are executed based on the display lists so as to generate image data. In other words instructions are executed, after C, M, Y, K are allocated to respective clusters. The generated image data is directly outputted to the data port 14 under a data transfer instruction.

[00027] FIG.4 shows information provided from the printer engine 7 to the printer controller 1. More specifically, information on the printer regarding temperatures of various parts of the printer, an elapsed time

after the printer was on, the type of printing medium, ink/toner and the like, is provided from the printer engine 7 to the printer controller 1. The provided information is converted to numeric data by the printer controller 1 and is returned to the printer engine 7 for utilizing to adjust the color table properly. The present invention is applicable to not only the color printer but also applicable to a color display, because colors displayed in the color display also change in accordance with the elapsed time and the temperature.

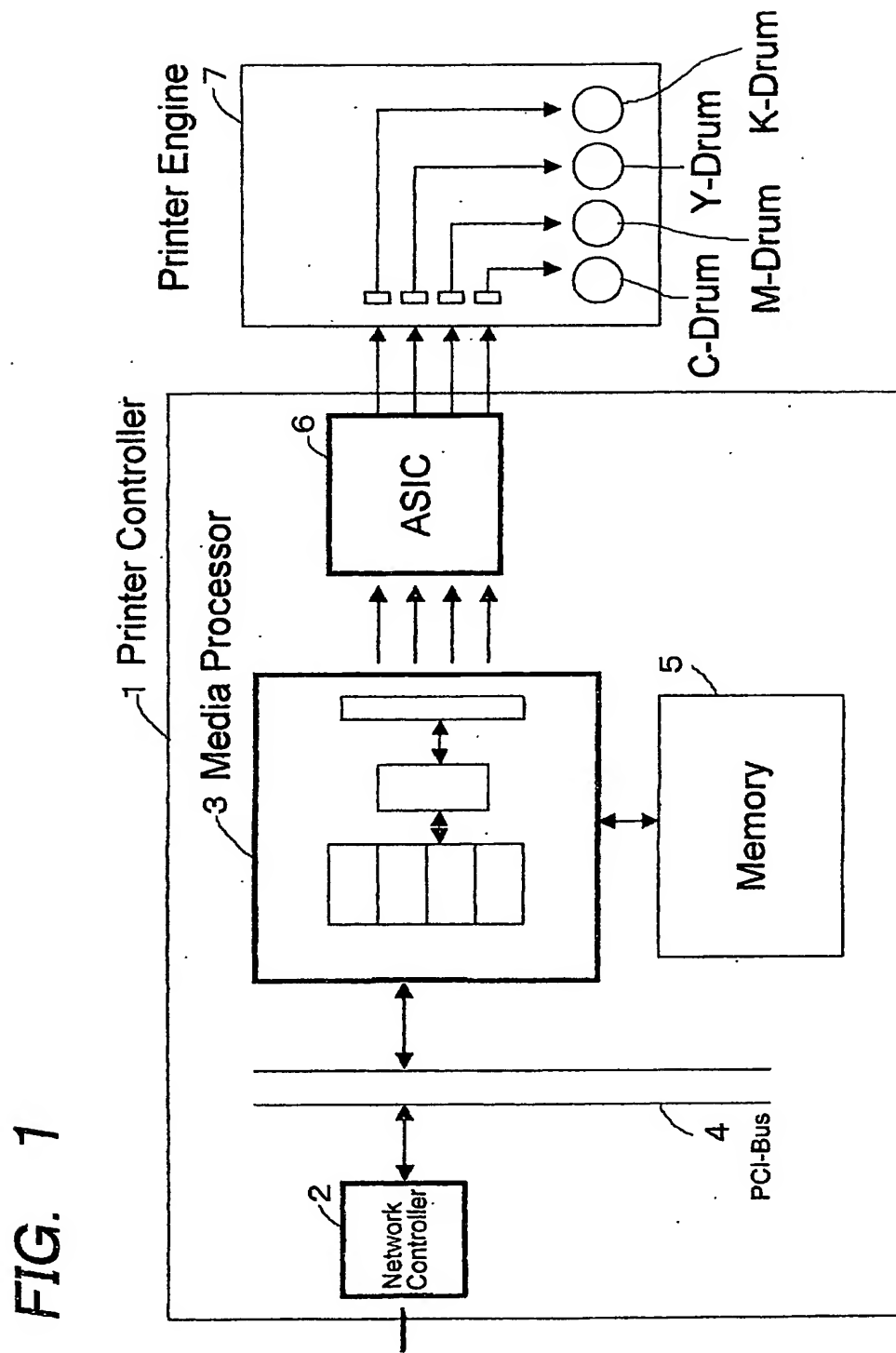
[00028] FIG.5 is the flow chart illustrating the adjusting procedure of the color table. The optimized color table is generated based on the information from the printer engine 7 for generating color data whenever printing operations are executed.

[00029] FIG.6 schematically shows an example of printed data. The figure illustrates a way to generate data by processing colors in accordance with properties of the object, when still J-PEG image data include properties of the object. Optimized data of the object can be generated by separating image areas such as human skin, unfocused portion shot by a one lens camera, a metallic material and so forth.

CLAIMS

1. A printer controller comprising:
- 5 a network controller for receiving data from an outside device;
 a digital signal processor having a VLIW structure capable of parallel processing; and
 a fixed logic LSI for receiving/transmitting data from/to a printer engine, wherein:
- 10 respective cyan, magenta, yellow and black as four primary colors are allocated to respective clusters in said VLIW structure and are processed in parallel; and
 processed results are transmitted to the printer engine via said fixed logic LSI.
- 15 2. The printer controller according to claim 1, wherein:
 further comprises an outputting means for continuously outputting a huge volume of data to the printer engine under an instruction from said digital signal processor.
- 20 3. A printer controller for processing image data by software comprising:
 a network controller for receiving data from an outside device;
 a digital signal processor;
 a fixed logic LSI for receiving/transmitting data from/to a printer engine; and further
 a means for receiving drum temperature data and a history of a printer
25 via the printer engine and for transforming received data into numeric data wherein:
 said numeric data is transmitted to the printer engine so that a color table of the printer is adjusted from time to time for a proper printing color tone.
- 30 4. The printer controller according to claim 3, wherein:
 received image data having peculiar object information in every area via said network controller is processed so as to optimize said image data

for proper printing and to output said optimized image data to the printer engine.



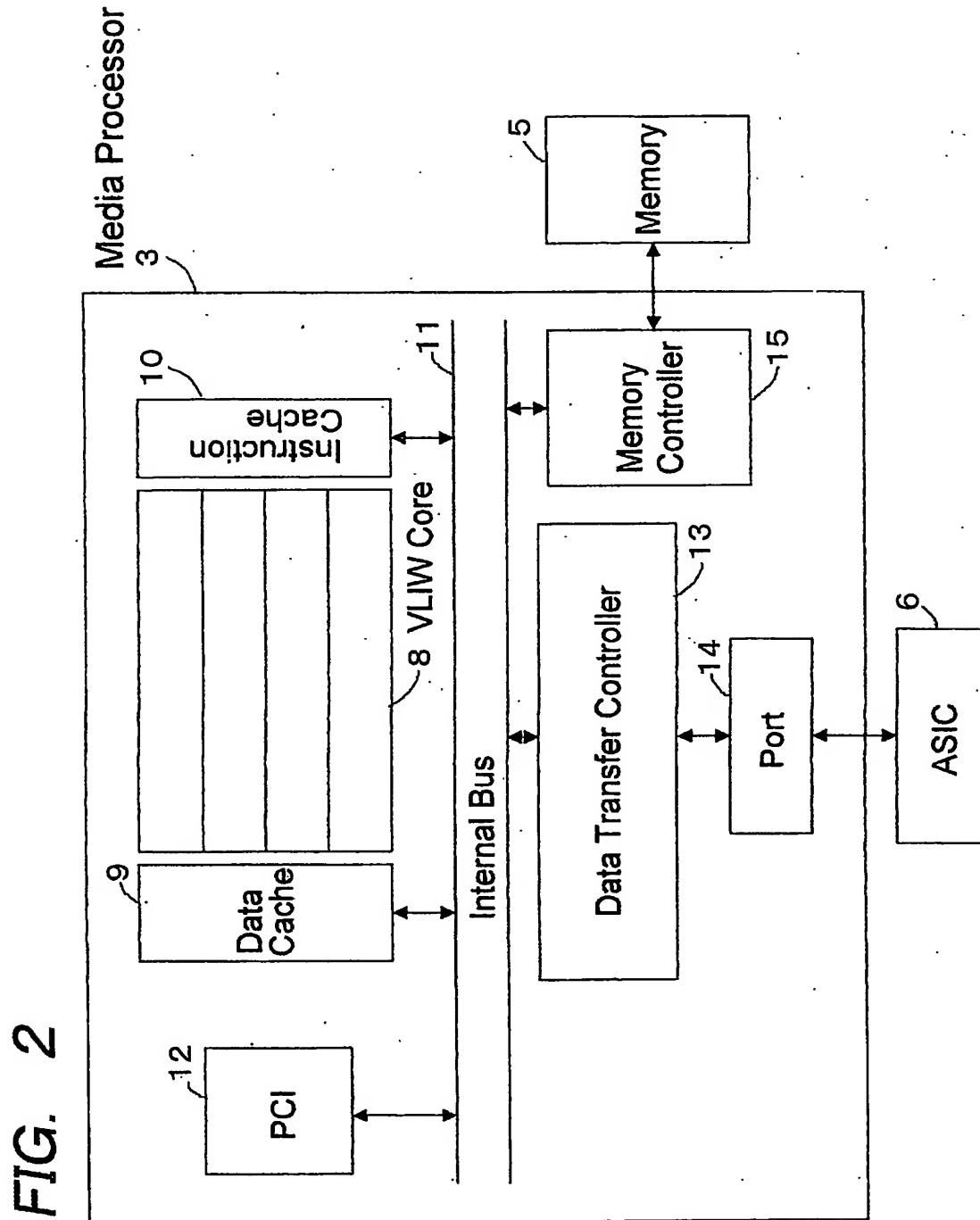
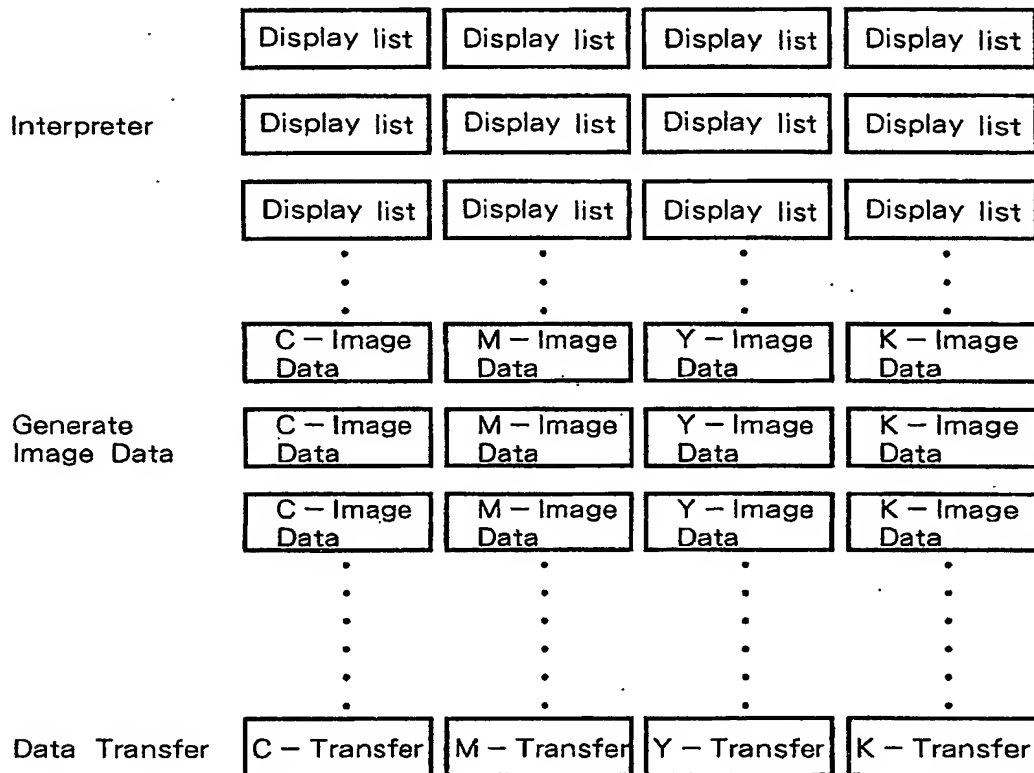
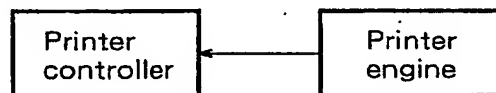
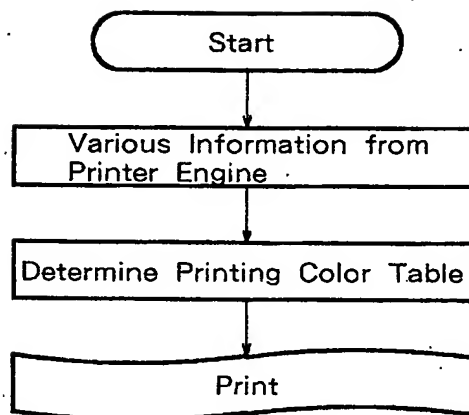
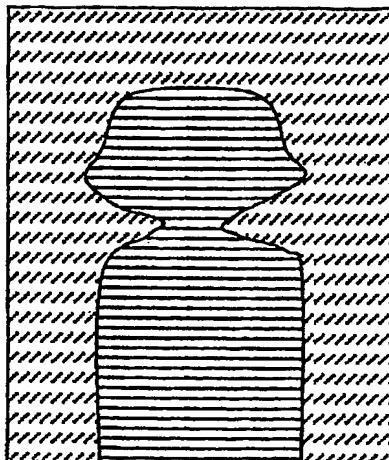


FIG. 3**FIG. 4**

Information on :

- Temperatures of various parts of printer
- Elapsed time after switch was on
- Kinds of papers
- Ink toners

FIG. 5**FIG. 6**

INTERNATIONAL SEARCH REPORT

PCT/IB 02/01904

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 G06K15/00 G06K15/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06K G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 38 31 817 A (MICROPLEX ELEKTRONISCHE DOKUME) 22 March 1990 (1990-03-22) column 2, line 9 - line 23; claims; figures ---	1-4
A	EP 1 160 619 A (EASTMAN KODAK CO) 5 December 2001 (2001-12-05) paragraph '0016! - paragraph '0024! ---	1-4
A	US 5 553 204 A (HIROYUKI KANEDA) 3 September 1996 (1996-09-03) column 5, line 45 -column 6, line 49; figures 1,2 ---	1,2
A	WO 93 01565 A (SEIKO EPSON CORP) 21 January 1993 (1993-01-21) ---	
	-/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

19 February 2003

Date of mailing of the international search report

28. 02. 2003

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

PCT/IB 02/01904

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

ational application No.
PCT/IB 02/01904

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1,2

A printer controller comprising a digital signal processor for processing the image data of four colours in parallel.

2. Claims: 3,4

A printer controller using data fed back from the print engine to adjust the tone of the produced images.

INTERNATIONAL SEARCH REPORT

Information on patent family members

PCT/IB 02/01904

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